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index difference of AlGaAs/AlAs DBR and requiring longer growth time. Using the present invention metal reflector combining with P-DBR, the number of AlGaAs/AlAs P-DBR pairs can be reduced and the growth time can be shorter. The whole VCSEL structure can be bonded to a high thermal conductivity Si substrate; therefore, the high temperature operating characteristics can be improved.

The benefits of the present invention are:

(1) to provide an LED chip structure with vertical current flow and requiring a single wire bonding that results in easy LED assembly and the manufacturing cost can be reduced.

(2) an LED chip size can be greatly reduced and compatible with the trend toward miniaturization, particularly in surface mount LED applications and saving the material cost.

(3) with good heat dissipation, therefore, the LED has better reliability performance and can be operated at much higher current.

(4) very easy to mass-produce in higher yield and lower cost.

(5) the metal reflector can withstand higher temperature without reflectivity degradation, therefore, allowing more flexibility in chip processing.

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As is understood by a person skilled in the art, the foregoing preferred embodiments of the present invention are illustrated of the present invention rather than limiting of the present invention. It is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims, the scope of which should be accorded the broadest interpretation.

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